CLAIMS

What is claimed is:

1. A distributed Bragg reflector (DBR) comprising:

a plurality of first material layers formed from a first material over a substrate and separated by a corresponding plurality of gaps; and

an additional layer, where the additional layer supports the plurality of first material layers at their periphery.

2. The DBR of claim 1, wherein the first material is indium phosphide (InP).

3. The DBR of claim 1, wherein the gap is filled with air.

4. The DBR of claim 1, wherein the first material is chosen from the group consisting of any material in the indium phosphide (InP) material system.

5. The DBR of claim 1, wherein the additional layer is a regrowth of the first material.

6. The DBR of claim 1, wherein the first material is a semiconductor.

7. The DBR of claim 1, wherein the first material is a dielectric.

8. A method for making a distributed Brag reflector (DBR), the method comprising the steps of:

forming a stack of epitaxial layers, the stack of epitaxial layers including alternating layers of a semiconductor material and a sacrificial material;

covering the stack with a mask;

etching the mask to expose the semiconductor material and the sacrificial material;

forming additional semiconductor material on the exposed semiconductor material and sacrificial material to form a support layer; and

selectively removing the sacrificial material to form air gaps between the remaining layers of semiconductor material.

9. The method of claim 8, wherein the stack is etched at an angle other than perpendicular with respect to a major surface of the stack.

10. The method of claim 8, wherein the semiconductor material is indium phosphide (InP).

11. The method of claim 8, wherein the sacrificial material is indium gallium arsenide (InGaAs).

12. The method of claim 8, wherein the support layer supports the remaining semiconductor material.

13. The method of claim 8, wherein the support layer is a regrowth of the semiconductor material.

14. A vertical-cavity surface-emitting laser (VCSEL), comprising:

a substrate;

a distributed Bragg reflector formed over the substrate and including a plurality of semiconductor material layers separated by air gaps;

an active region formed over the distributed Bragg reflector, the active region including a current confinement region and a tunnel junction;

a second reflector formed over the active region;

electrical contacts associated with the active region and the distributed Bragg reflector;

where the distributed Bragg reflector includes a support layer to support the layers of semiconductor material.

15. The VCSEL of claim 14, wherein the semiconductor material is indium phosphide (InP).

16. The VCSEL of claim 14, wherein the semiconductor material is chosen from the group consisting of any material in the indium phosphide (InP) material system.

17. The VCSEL of claim 14, further comprising an additional semiconductor material layer formed between the active region and the second reflector.

18. The VCSEL of claim 14, further comprising:

an air gap located adjacent the active region;

a conductive layer located between the air gap and the second reflector; and

an additional set of electrical contacts associated with the conductive layer, the additional set of electrical contacts configured to receive an electrical signal and alter the light output wavelength of the VCSEL by causing the conductive layer to move in response to the electrical signal resulting in a tunable VCSEL.

19. The VCSEL of claim 14, wherein the second reflector is an air gap-supported distributed Bragg reflector.

20. The VCSEL of claim 14, wherein the second reflector is a dielectric distributed Bragg reflector.

21. The VCSEL of claim 14, wherein the support layer is a regrowth of the semiconductor material.

22. A method for making a vertical-cavity surface-emitting laser (VCSEL), comprising:

forming a substrate;

forming a distributed Bragg reflector over the substrate, the distributed Bragg reflector including alternating layers of a semiconductor material and a sacrificial material;

forming an active region over the distributed Bragg reflector, the active region including a current confinement region and a tunnel junction;

forming a second reflector over the active region;

covering the distributed Bragg reflector, the active region, and the second reflector with a mask;

etching the mask to selectively expose portions of the semiconductor material and the sacrificial material;

forming additional semiconductor material on the exposed portions of the semiconductor material and sacrificial material to form a support layer associated with the distributed Bragg reflector;

selectively removing the sacrificial material to form air gaps between the remaining layers of semiconductor material; and

forming electrical contacts associated with the active region and the distributed Bragg reflector.

23. The method of claim 22, wherein the distributed Bragg reflector and the second reflector are etched at an angle other than perpendicular with respect to a major surface of the VCSEL.

24. The method of claim 22, wherein the semiconductor material is indium phosphide (InP).

25. The method of claim 22, wherein the sacrificial material is indium gallium arsenide (InGaAs).

26. The method of claim 22, wherein the semiconductor material is chosen from the group consisting of any material in the indium phosphide (InP) material system.

27. The method of claim 22, wherein the additional semiconductor material supports the remaining semiconductor material.

28. The method of claim 22, further comprising forming an additional semiconductor material layer between the active region and the second reflector.

29. The VCSEL of claim 22, further comprising:

forming a layer of additional sacrificial material adjacent the active region;

forming a conductive layer over the additional sacrificial layer;

selectively removing the additional layer of sacrificial material to form an air gap between the active region and the conductive layer; and

forming an additional set of electrical contacts associated with the conductive layer, the additional set of electrical contacts configured to receive an electrical signal and alter the light output wavelength of the VCSEL by causing the conductive layer to move in response to the electrical signal resulting in a tunable VCSEL.

30. The VCSEL of claim 22, wherein the second reflector is an air gap supported distributed Bragg reflector.

31. The VCSEL of claim 22, wherein the second reflector is a dielectric distributed Bragg reflector.